

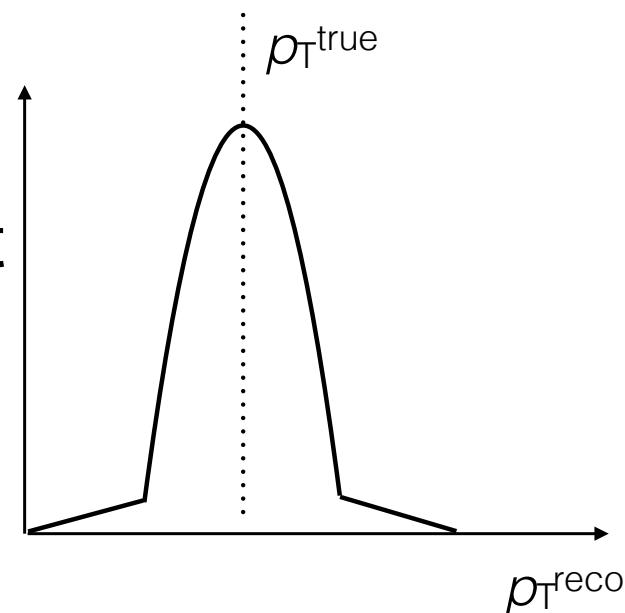
# JET-STRUCTURE REPORT FOR GENERAL MEETING

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# Descoping options

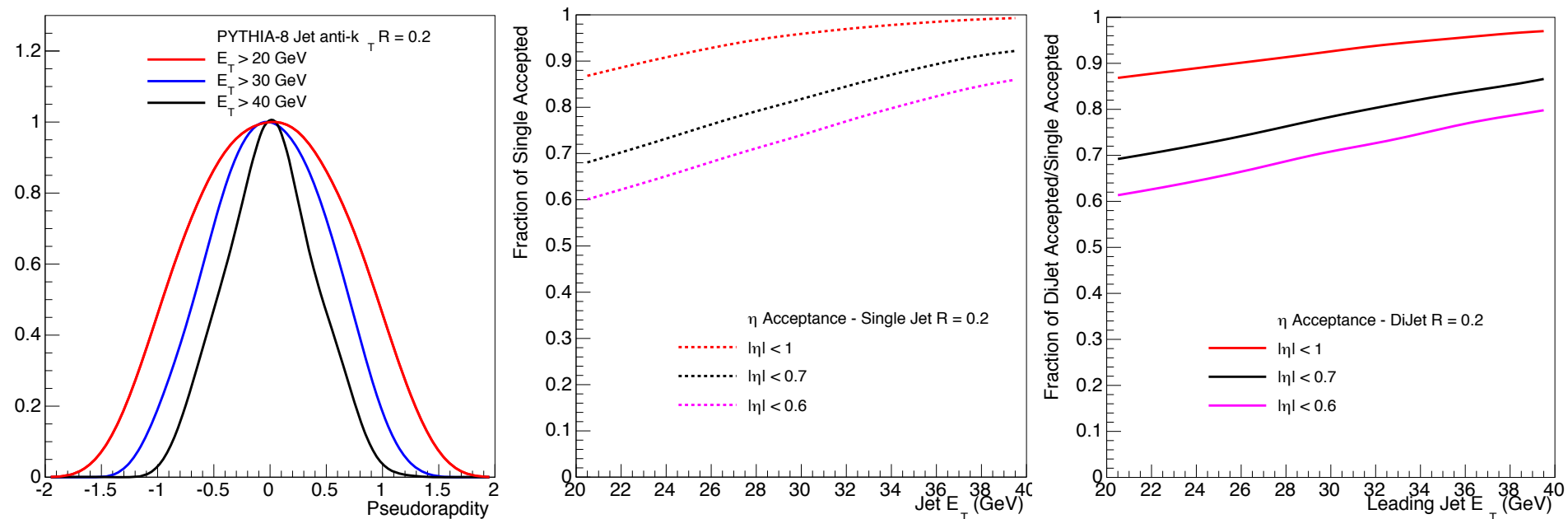
- Tracking and calorimetry are the biggest questions for jet structure
  - Tracking affects charged particle measurements
    - Need to quantify efficiency/resolution/purity inside jet cone
  - EMCal+HCal options affect jet energy measurements
    - Need to quantify jet response
      - Resolution
      - non-Gaussian tails
- We have a plan to specifically target these two issues described in the following slides



# Descoping options

- EMCal – Reduce Acceptance  $\sim |\eta| < 0.6$ 
  - Jet energy measurements affected across the boundary
  - Statistics reduced for both photons and inclusive jets
  - Statistics reduction can be checked at generator level
  - Jet resolution with only HCal?
    - Complicated, may be correctable, hard to check on this time scale
- EMCal – Ganging towers together
  - Not key for jet structure  $\rightarrow$  Calibrate JES
  - Check photon resolution? (Volunteers)
- Trigger – Not a large effect for rare probes

# EMCal Acceptance – DiJet containment



- Reduced acceptance  $\rightarrow$  Reduced DiJet statistics
  - Generator only analysis
  - Especially key for  $R > 0.2$  and/or low  $p_T$  jets
  - Note: Pythia 8 tune not identical to the MIE, slightly better performance

# Strawman simulation proposal

- $N_{\text{evt}} = 10\text{k}$  full G4 calo sim, of  $p_T = 50\text{-}55$  GeV dijet events
  - Generate falling jet spectrum with truth-level filtering
  - PYTHIA events only — want to know jet response from detector, not from UE
  - repeat for each calo configuration, so for 3 configurations (nominal, 1/2 EMCal, short HCal) this is 30k events total
  - **Key observable: jet energy response  $p_T^{\text{reco}} / p_T^{\text{true}}$**
- 10k sample of Pythia8 dijet produced
  - /phenix/upgrades/decadal/dvp/GeneratorInputFiles/
  - $R=0.4$  truth jet,  $50 \text{ GeV} < p_T < 55 \text{ GeV}$  and  $|\eta| < 0.6$
- Chris has started to “kick the wheels” for looking at the full G4 simulation
  - Hijing files are extremely large and memory intensive

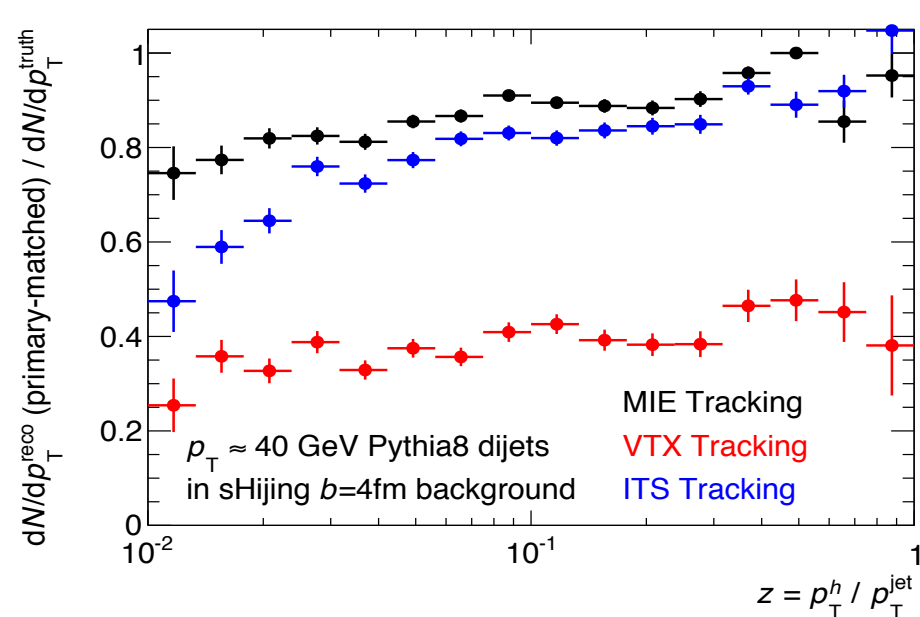
# Strawman simulation proposal

- **If resources and time** are available could extend to:
  - explore multiple  $p_T$  bins
  - explore quark/gluon response differences at low  $p_T$
  - explore effects of UE
- Take the same set of  $N_{\text{evt}} = 10\text{k}$ ,  $p_T = 50\text{-}55$  GeV dijet events
  - Do tracking-only simulation, for multiple tracking options
  - For this study, repeat for PYTHIA only *and* for HIJING-embedded
- For 3 (e.g.) tracking configurations, this is 10k events x 3 configurations x 2 embeddings = 60k w/tracking-only sim
- **Key observable: efficiency, fake rate, resolution vs.  $z$**

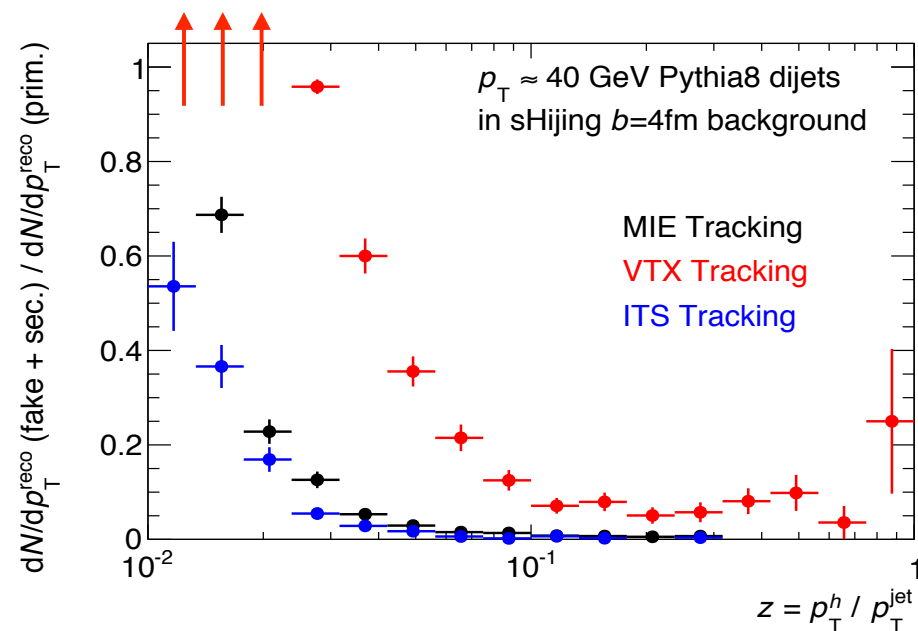
# Strawman simulation proposal [Cont]

- **If resources and time** are available could extend to:
  - Run 10k+ pure-HIJING events, w/ fast-sim calo matching?
  - Toy unfolding to translate performance into FF systematics?
  - Estimate statistical uncertainties vs.  $z$  for the FF of  $p_T = 40, 50, 60$  GeV jets?
- G4 tracking studies have been underway in Simulations meeting.
  - On next slide, study of charged particle performance for 40 GeV dijets, with some current (at the time) tracking options.
  - Note: “VTX” on next slide is 2 layers with existing dead areas, not one reconfigured layer...

- Comparing tracking configurations: **MIE** ideal seven-layer silicon, reused **VTX** pixels + ganged strips, seven-layer ALICE **ITS**
- Full G4 tracking simulation, embedded in  $b=4\text{fm}$  Hijing background
- Fragmentation functions for  $p_T \sim 40\text{ GeV}$  dijets



$\text{truth-matched } dN/dp_T^{\text{reco}} / dN/dp_T^{\text{truth}}$



$\text{fake+secondary } dN/dp_T^{\text{reco}} / \text{truth-matched } dN/dp_T^{\text{truth}}$

- How big are corrections for eff. and  $p_T$  resolution together?
- What is relative fake rate inside jet cone?



# Summary simulation proposal

- Propose two simulation samples of the **same** 10k  $p_T = 50\text{-}55$  GeV dijet events:
  - 30k G4 full-calo
  - 60k G4 tracking-only
- **Key observables:**
  - **jet energy response  $p_T^{\text{reco}} / p_T^{\text{true}}$**
  - **efficiency, fake rate, resolution vs.  $z$**
- Generator level studies:
  - Dijet containment
- Starting to put simulation pieces in place, any help would be great!
- Next meeting – Wednesday afternoon time TBD

# Full G4 calo simulation

- C. Pinkenburg has kicked off the full G4 simulation of the 10k Pythia sample produced by Dennis! (update as of 10 min ago)
  - **10 event sample** can be found at:
  - /sphenix/sim/sim01/production/aldcharge/pythia8/G4Hits\_sPHENIX\_pythia8dijet\_0000.root